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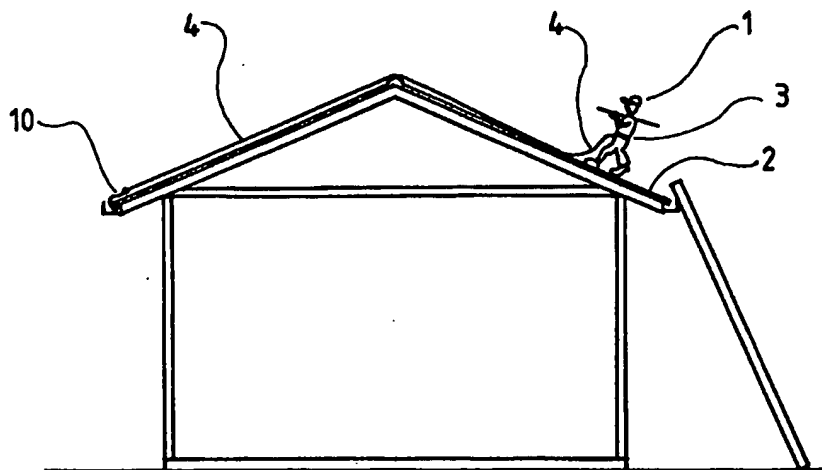
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(54) Title: A ROOF SAFETY SYSTEM



(57) Abstract

A safety system for roof workers comprises roof fixing means (10) adapted to be fixed to one edge of a roof (2), a harness (3) adapted to be worn by a roof worker on the opposite side of the roof, and a safety rope connecting the harness (3) to the roof fixing means (10). The roof fixing means may be a roof anchor (11) having a hook portion which is hooked to the lower edge of the roof cladding, such as a metal sheet (25) or roofing tile (26). A clamping bolt (20) fixes the roof anchor (11) to the cladding. Alternatively, the roof fixing means (10) may be a clamp (30) adapted to be mounted to a rafter or similar roof frame member (39). The clamp has a toothed pawl (33) which resists movement of the clamp along the rafter. A clamping bolt (38) can also be provided to fix the clamp (30) relative to the rafter (39).

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"A ROOF SAFETY SYSTEM"

THIS INVENTION relates to a safety system for workers on roofs or similar elevated locations. In particular, the invention is directed to a roof anchor
5 and/or clamp suitable for use with a rope and safety harness for rooftop workers.

The disclosure of Australian patent application No. PP2468, from which this application claims priority, is incorporated herein by reference.

10

BACKGROUND ART

In many areas, occupational health and safety regulations require that scaffolding be erected around the perimeter of a roof to serve as a safety barrier for
15 workers on the roof. The erection of such scaffolding is not only time consuming, but also expensive.

Furthermore, for small roof jobs, such as roof spot repair or installation of a ventilator, the cost of scaffolding is considerably more than the cost of the
20 actual job. Since the cost of roof scaffolding is prohibitive in such circumstances, some roof workers may be tempted to carry out small jobs without scaffolding or other safety measures, thereby leading to an unsafe work environment.

25 There is a known "rope and harness" safety system for roofworkers. The roofworker wears a harness (e.g. a belt) which is connected to one end of a safety rope. The other end of the safety rope is connected to an anchor point at an upper portion of the roof, e.g. at the
30 roof ridge. Some buildings may have an exposed hook at or near the roof ridge to permit quick connection of the safety rope.

Although the known rope and harness system is significantly cheaper than perimeter scaffolding, it
35 still has an inherent disadvantage. Namely, the worker must climb to the upper part of the roof to connect the safety line. Until the line is connected, the worker is at risk. Similarly, at the end of the job, the worker

must disconnect from the roof and descend to a ladder or scaffold at the roof edge. During such descent, the worker is again at risk as the safety rope is no longer connected.

5 It is an object of this invention to provide an improved safety system for roofworkers. In particular, it is an object of this invention to provide a roof anchor and/or rafter clamp for use with a rope and harness safety system.

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SUMMARY OF THE INVENTION

The invention relates to a roof safety system having roof fixing means adapted to be fixed adjacent to one edge of a roof, a harness adapted to be worn by a
15 roofworker, and a safety line connected between the roof fixing means and the harness, the safety line being of sufficient length to extend to the opposite edge of the roof, yet short enough to arrest the fall of a roofworker from the opposite edge.

20 In one embodiment, the roof fixing means comprises a roof anchor adapted to hook onto the bottom edge of the roof cladding, which may be sheet metal or tiles for example. The roof anchor is typically of hook-like configuration. The hook portion is variable in size
25 to suit cladding of different thickness.

In a preferred version of this embodiment, the roof anchor is of T-shaped configuration, having a shank and a crosspiece. The crosspiece has at least one finger portion which engages under the bottom edge of the roof
30 cladding.

The shank may be of arched section to suits its application to a corrugated iron roof. A hook or loop is provided on the shank, for easy connection to one end of the safety line.

35 In another embodiment, the roof fixing means is a clamping mechanism adapted to clamp onto a rafter, truss top chord or like roof frame member. The rafter clamp is suitable for use on uncovered roofs.

In a preferred version of this embodiment, the clamping mechanism has at least one toothed cam pawl which is biased against the frame member. The pawl resists movement of the clamping mechanism relative to the frame member under load.

Both the roof anchor and the clamping mechanism may have additional clamping means to fix the anchor or clamping mechanism in position.

In order that the invention may be more fully understood and put into practice, embodiments thereof will now be described with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic elevation showing the rope and harness safety system of this invention, in use;

Fig. 2 is an exploded perspective view of a roof anchor for use in the rope and harness system;

Fig. 3 is an exploded perspective view of the roof anchor of Fig. 2 being fitted to a metal roof;

Fig. 4 is a sectional elevation of the roof anchor fitted to a metal roof;

Fig. 5 is an underside perspective of the roof anchor fitted to a metal roof;

Fig. 6 is a sectional elevation of the roof anchor fitted to a tiled roof;

Fig. 7 is an underside perspective of the roof anchor fitted to a tiled roof;

Fig. 8 is a perspective of a roof clamp suitable for use with a rope and harness system;

Fig. 9 is a front elevation of the roof clamp of Fig. 8;

Fig. 10 is a perspective view of the roof clamp of Fig. 8 fitted to a rafter.

DESCRIPTION OF PREFERRED EMBODIMENTS

In the rope and harness safety system illustrated schematically in Fig. 1, a person 1 working

on a roof 2 at one side of a building wears a harness 3 which is connected by safety rope 4 to roof fixing means 10 on the other side of the building, i.e. on the opposite side of the roof ridge. The safety rope 4 is of such length that it permits the worker 1 to move over the roof 2, yet will arrest the fall of the roof worker in the event that the worker slips or falls off the roof. The safety rope may be of adjustable length, or adjustably connected to the safety harness 3 and/or the roof fixing means, so that the worker can set the effective length of the safety rope for the particular roof on which it is used.

In one embodiment of this invention, the roof fixing means is a roof anchor 11 as shown in Figs. 2-7. The illustrated roof anchor is suitable for roofs of corrugated iron or sheet metal, tiled roofs, and other clad roofs.

As shown in Figs. 2-4, the roof anchor 11 is generally T-shaped, and comprises a shank portion 12 connected at its front end to an angle-section crosspiece 13. The crosspiece 13 has a pair of vertically spaced slots 14A, 14B, as well as a threaded stud 15 extending forwardly of the crosspiece 13.

An angle section 16 is provided for use with the anchor 11. The angle section 16 has an aperture 17 in one arm thereof ("the apertured arm"), which is dimensioned to receive the threaded stud 15. A wing nut 18 is also provided for threading onto the stud 15. The angle piece 16 may be mounted onto the threaded stud 15 in either of two orientations as shown in Fig. 2.

Depending on the orientation, the other arm of angle piece 16 ("the finger arm") locates in one or other of the slots 14A, 14B, and forms a finger extending rearwardly under the crosspiece 13. In side elevation, the shank 12, crosspiece 13 and finger arm form a generally C-shaped anchor hook which, in use, can be hooked over the bottom edge of a roofing sheet or tile as described below. However, any other hook-like

configuration may be used.

A boss 19 is provided on the crosspiece 13, the boss 19 having a threaded throughhole. A clamping bolt 20 is provided with the roof anchor 11, for threading into the throughhole in boss 19. The bolt 20 may suitably have an angled handle to enable it to be manually threaded into the boss 19.

A hook or loop 21 is provided at the rear end of the shank 12, i.e. the end opposite the crosspiece, for connection to the safety rope 4.

The shank 12 is increasingly arched in transverse section along its length, and has a slot 22 extending longitudinally along the top of the arched shank. A curved washer plate 23 of matching curvature may be provided with the shank 12, and has an aperture 24 which, in use, is aligned with the slot 22 thereunder. Typically, the roof anchor 11 is made from mild steel, but any other suitable material will suffice.

In one application, the roof anchor 11 is hooked to the bottom edge of a sheet of roofing iron 25, usually the lowest sheet, as depicted in Figs. 3-5. The roof anchor 11 is placed on the roofing sheet 25 so that the angled crosspiece 13 overhangs the bottom edge of the sheet. The angle section 16 is placed on the threaded stem 15 in the orientation shown in Fig. 3, so that the finger arm passes through slot 14A and under the bottom edge of the roof sheet 25 (as depicted in Fig. 4). Wing nut 18 is used to secure the angle section 16 to the threaded stem 15. The crosspiece 13 and finger arm effectively form a hook configuration around the bottom edge of the roof sheet 25.

The clamping bolt 20 is then screwed manually into boss 19 to clamp the roofing sheet 25 between the bolt and the finger arm of angle section 16. This clamping action secures the roof anchor to the roof and prevents it from sliding off the roof when there is no load on it. Other suitable clamping mechanisms can be used instead of the clamping bolt.

Further, or in the alternative, if the roof anchor 11 is being used on a screwed-down corrugated iron roof, a screw fastener is first removed from a bottom sheet of corrugated iron and the washer plate 23 is placed on the shank 12 so that the aperture 24 in the washer plate 23 is aligned with both the slot 22 and the hole in the roof sheet from which the screw fastener was removed. The screw fastener can then be inserted in the aligned aperture 24 and slot 22 and screwed back into its original hole to thereby fasten the roof anchor 11 to the roof.

The roof anchor 11 can be fixed in position by an operator standing on a ladder at the bottom edge of the roof. That is, the operator need not climb onto the roof in order to fix the roof anchor.

Once the roof anchor 11 is fixed in position, the safety rope 4 is attached to loop 21, and the other end of the rope is thrown over the roof ridge as shown in Fig. 1. The operator moves to the opposite side of the building, and can reach the other end of the rope by climbing the ladder. The other end of the rope is then attached to a safety harness worn by the operator while the operator is still on the ladder. That is, the operator need not climb onto the roof before connecting to the safety system.

While on the opposite side of the roof, the operator is prevented from falling to the ground by the safety rope 4 connected to the roof anchor hooked to the bottom edge of the roof sheet 25.

Upon completion of the roof tasks, the operator is able to return to the ladder before disconnecting the safety rope from his harness. The roof anchor can be retrieved from the other side of the building by removing bolt 20, and sliding the anchor out from the edge of the roof sheet 25. (The washer plate 23 would also need to be removed if used).

The above procedure is repeated on the other side of the building, if work is to be done on the

opposite roof.

Figs. 6 and 7 illustrate another application of the roof anchor 11, namely on tiled roofs. As tile cladding is thicker than sheet metal cladding, the angle piece 16 is inverted before fitting to the threaded stud 15, to thereby create a larger clearance between the finger arm of the angle section 16 and the crosspiece 13, as shown in Fig. 6. The combination of the crosspiece 13 of the anchor 12 and the finger arm 16 forms a generally C-shaped arrangement which is hooked onto the lower end of a tile 26, usually in the bottommost course of roof tiles.

Again, the bolt 20 is manually threaded into boss 19 to clamp the roof tile 26 between the finger arm 16 and the bolt, thereby ensuring that the roof anchor 11 does not slip off the roof.

It will be apparent to those skilled in the art that the abovedescribed roof anchor and roof safety system have several advantages, including

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(i) The roof anchor can be constructed easily and economically.

(ii) The roof anchor is compact, and can be carried in the worker's vehicle for ready access.

(iii) The roof anchor is quickly and easily installed on a roof, without special tools.

30 (iv) The use of perimeter scaffolding is avoided.

(v) The roof anchor allows a roof worker to be connected to the roof safety system prior to climbing onto a roof, and to remain connected after climbing back onto the ladder, so that the worker remains connected to the safety system at all times while on the roof.

(vi) The roof anchor is suitable for both metal and

tile roofs.

On unsheeted or uncovered roofs, the roof anchor shown in Fig. 2 may not be suitable. In another embodiment of this invention, the roof fixing means 10 is in the form of a rafter clamp for use in such situations.

A rafter clamp 30 is illustrated in Figs. 8-10 and comprises a member 31 of inverted channel section having a hook or loop 32 at its rear end for connection to the safety rope 4. A toothed cam pawl 33 is located in a slot 34 in one side of the channel member 31, and is pivotally mounted on an upright pivot pin 35. A coil spring 36 is provided on the pivot pin 35 to bias the pawl 33 inwardly, i.e. clockwise when viewed from above.

A boss 37 is provided on the same side of the channel member 31 as the pawl 33. The boss 37 has a threaded through bore which receives a clamping bolt 38. The bolt 38 is preferably provided with a handle portion to enable it to be screwed into the boss 37 manually.

The rafter clamp 30 is designed to be fixed to a rafter member (whether it is a separate frame component or the top chord of a truss), or any similar roof frame member. The channel member 31 is dimensioned to receive the roof frame member therein. The fixing of the clamp 30 to a rafter is illustrated in Fig. 10.

In a typical application, the clamp 30 is pushed down onto an exposed rafter or similar frame member 39 and in a forward direction, i.e. towards the bottom end of the rafter. This causes the toothed cam surface of the pawl 33 to rotate against its spring bias and bite into the rafter, preventing rearward movement of the clamp 30 relative to the rafter.

The spacing between the side walls of the channel member 31 is wider than the rafter (in order to comfortably accommodate different size rafters), but the biased pawl 33 urges the opposite side of the channel member 31 against the opposed side face of the rafter 39. The bolt 38 is screwed into boss 37 and against the

rafter 39. This not only secures the rafter clamp to the rafter and prevents it from slipping off, but also ensures that the whole face of the opposite side wall of the channel member 31 is flush against its opposed side face of the rafter 39. In this manner, the rafter clamp is aligned with the rafter, and the load applied to the rafter clamp acts longitudinally along the rafter.

The removal of the clamp 30 is the reverse of the fitting procedure. Namely, the bolt 38 is manually unscrewed, and the rafter clamp 30 is pushed forward (to bias the pawl 33 away from the rafter), and up (to lift the clamp off the rafter).

It will be apparent to those skilled in the art that the roof clamp 30 possesses the advantages of the roof anchor described above. In addition, the rafter clamp 30 has the advantage that it can be used on uncovered roof frames, or tiled roofs after removal of a tile to uncover a rafter, or other roofs having coverings which may not support the roof anchor.

The foregoing describes only some embodiments of the invention, and modifications which are obvious to those skilled in the art may be made thereto without departing from the scope of the invention.

For example, the pawl 33 of the rafter clamp may be replaced by a vice-like or over-centre clamping mechanism.

CLAIMS:

1. A roof safety system having roof fixing means adapted to be fixed to a roof adjacent to one edge thereof, a harness adapted to be worn by a roof worker,
5 and a safety line connected between the roof fixing means and the harness, the safety line being, in use, of sufficient length to extend to the opposite edge of the roof, yet short enough to arrest the fall of a roof worker from the opposite edge.
- 10 2. A roof safety system as claimed in claim 1, wherein the roof fixing means is a roof anchor adapted to hook onto the bottom edge of the roof cladding.
3. A roof safety system as claimed in claim 2, wherein the roof anchor is of hook-like configuration.
- 15 4. A roof safety system as claimed in claim 3, wherein the hook-like configuration of the roof anchor is of variable size to accommodate cladding of different thickness.
5. A roof safety system as claimed in any one of
20 claims 2 to 4, wherein the roof anchor includes clamp means for fixing the roof anchor to the cladding.
6. A roof safety system as claimed in any one of claims 2 to 5, wherein the roof anchor is generally of T-shaped configuration, having a shank portion and a
25 crosspiece, the crosspiece being adapted to be placed along the bottom edge of the roof cladding in use.
7. A roof safety system as claimed in claim 1, wherein the roof fixing means is a clamping mechanism adapted to be mounted to a roof frame member.
- 30 8. A roof safety system as claimed in claim 7, wherein the clamping mechanism includes at least one toothed cam member adapted to engage the frame member and resist movement of the clamping mechanism relative to the frame member under load.
- 35 9. A roof safety system as claimed in claim 7 or 8, wherein the clamping mechanism also includes clamp means for fixing the clamping mechanism to the roof frame member.

10. A roof anchor for use in a roof safety system, the roof anchor having a hook-like configuration and being adapted to hook onto the bottom edge of the roof cladding.
- 5 11. A roof anchor as claimed in claim 10, wherein the hook-like configuration of the roof anchor is of variable size to accommodate cladding of different thickness.
- 10 12. A roof anchor as claimed in claims 10 or 11, wherein the roof anchor includes clamp means for fixing the roof anchor to the cladding.
- 15 13. A clamping mechanism for use in a roof safety system, the clamping mechanism being adapted to be mounted to a roof frame member, and having at least one toothed cam member adapted to engage the frame member and resist movement of the clamping mechanism relative to the frame member under load.
- 20 14. A clamping mechanism as claimed in claim 13, further including clamp means for fixing the clamping mechanism to the roof frame member.
15. A clamping mechanism as claimed in claim 13 or 14 and having a body of inverted channel section, the toothed cam member being pivotally mounted in one side of the channel section.

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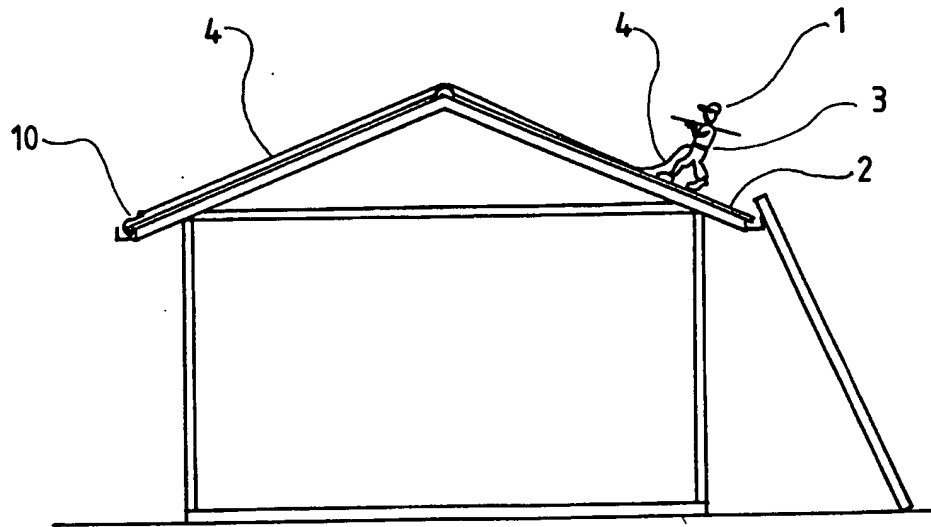


Fig. 1

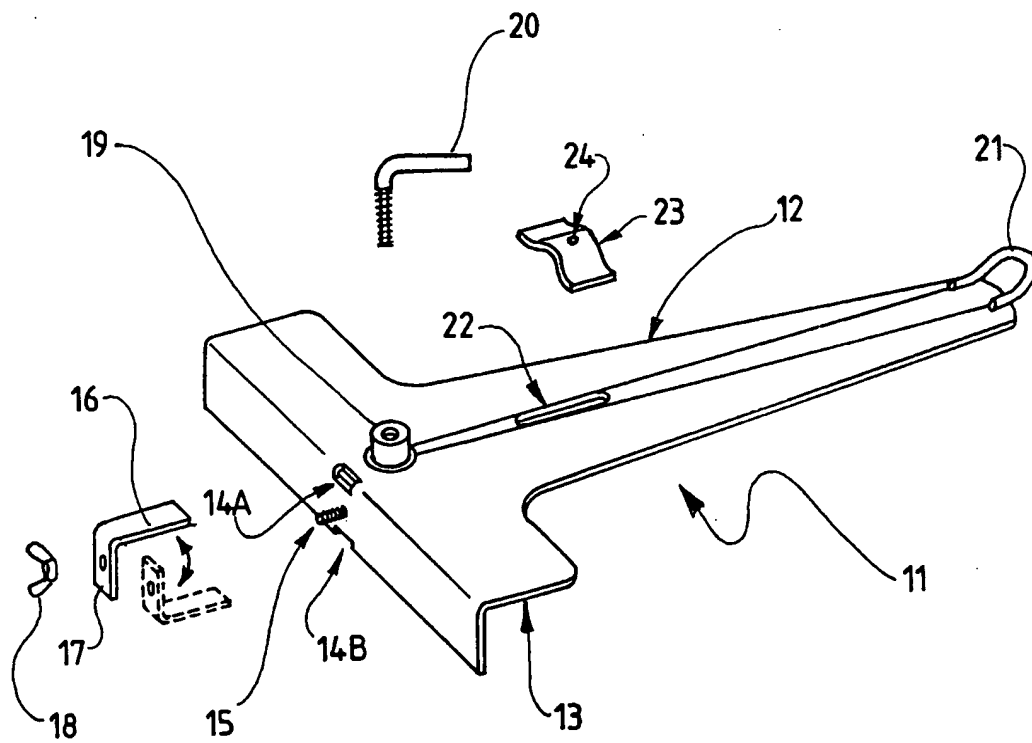


Fig. 2

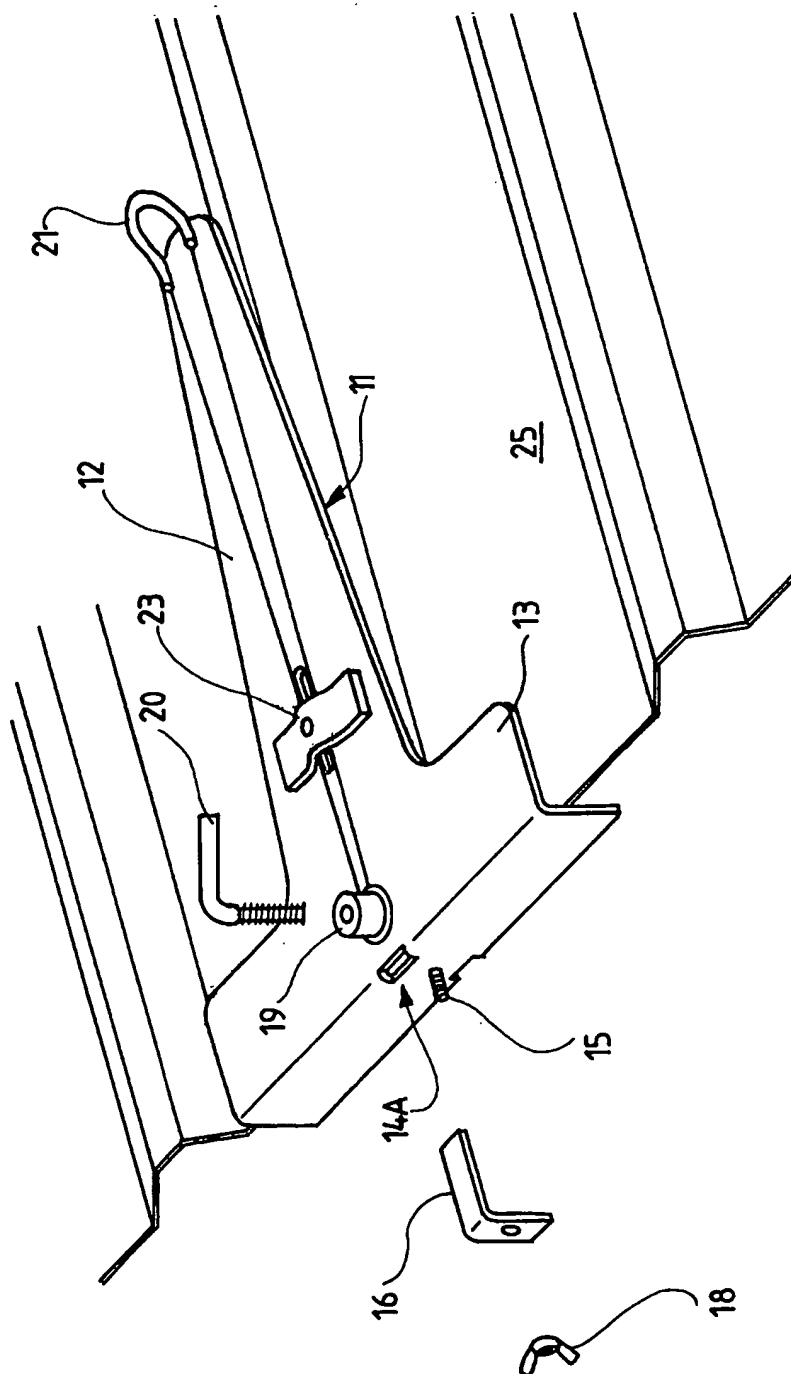


Fig. 3

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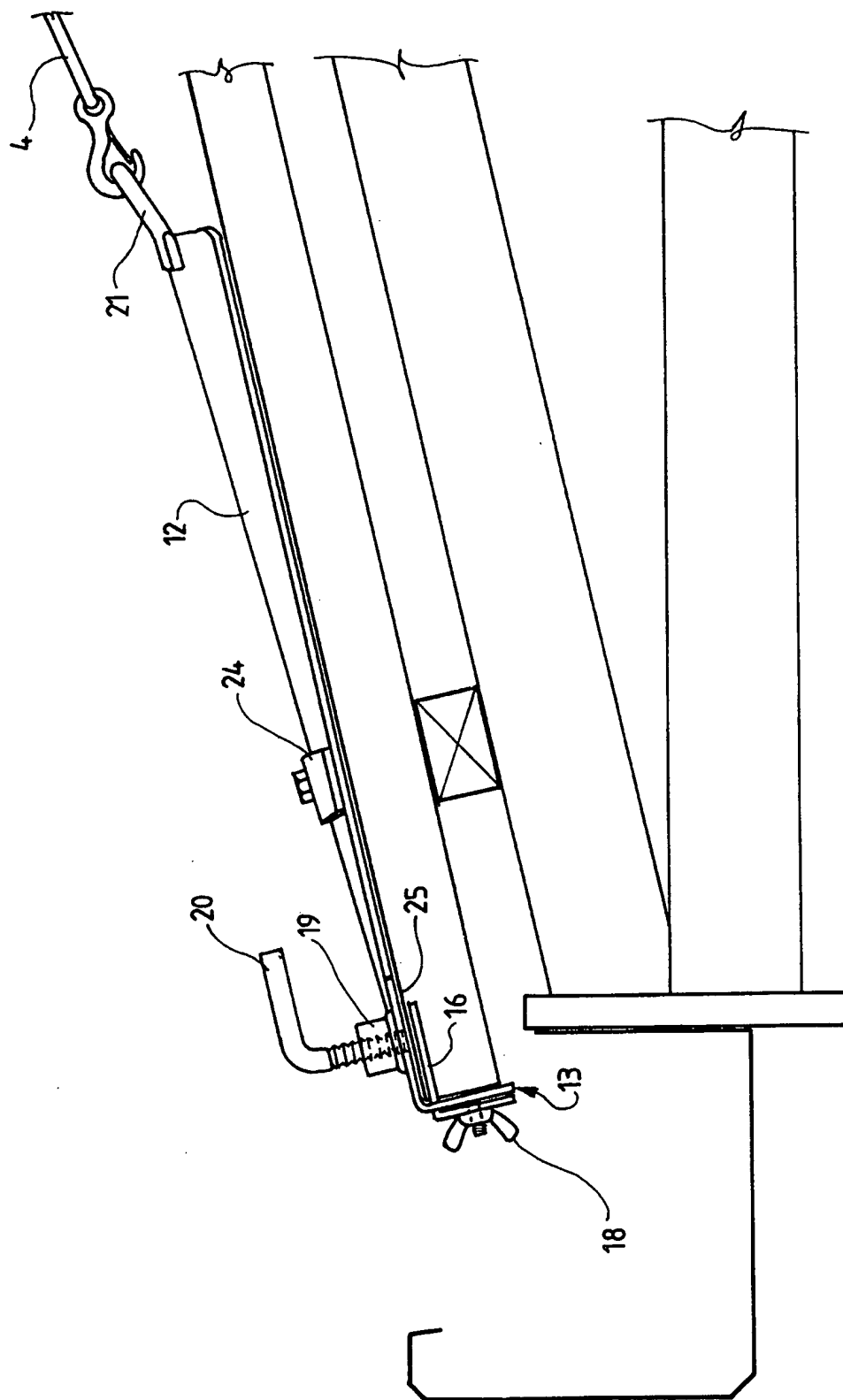


Fig. 4

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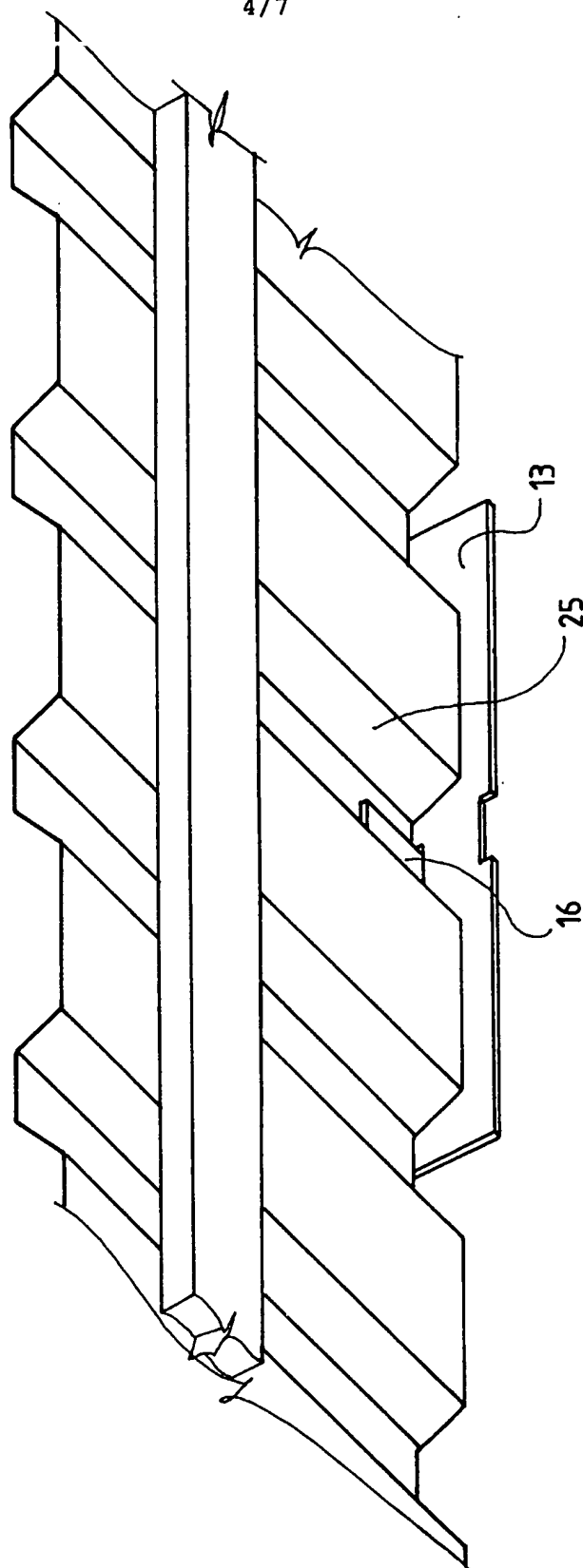


Fig.5

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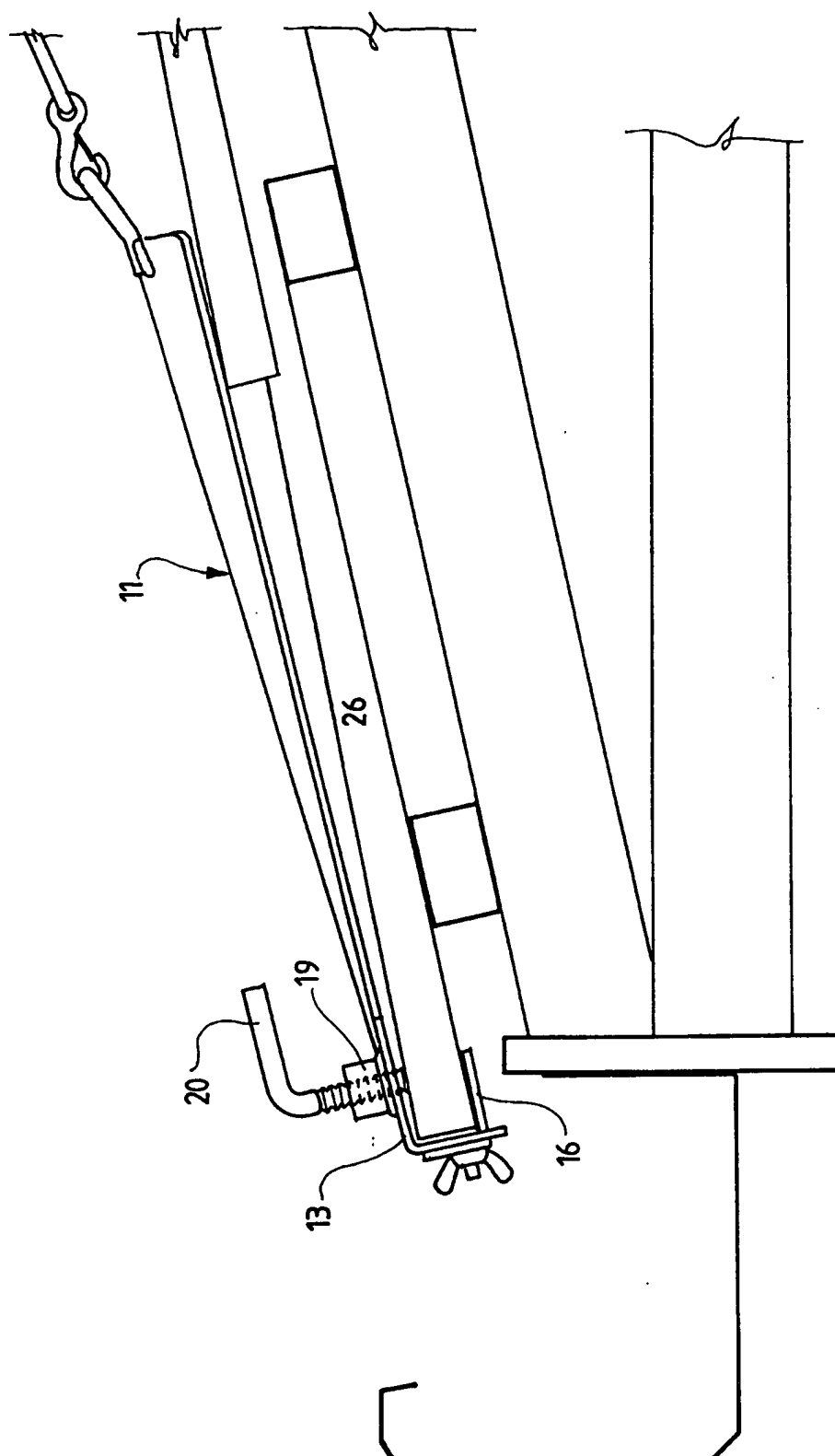


Fig. 6

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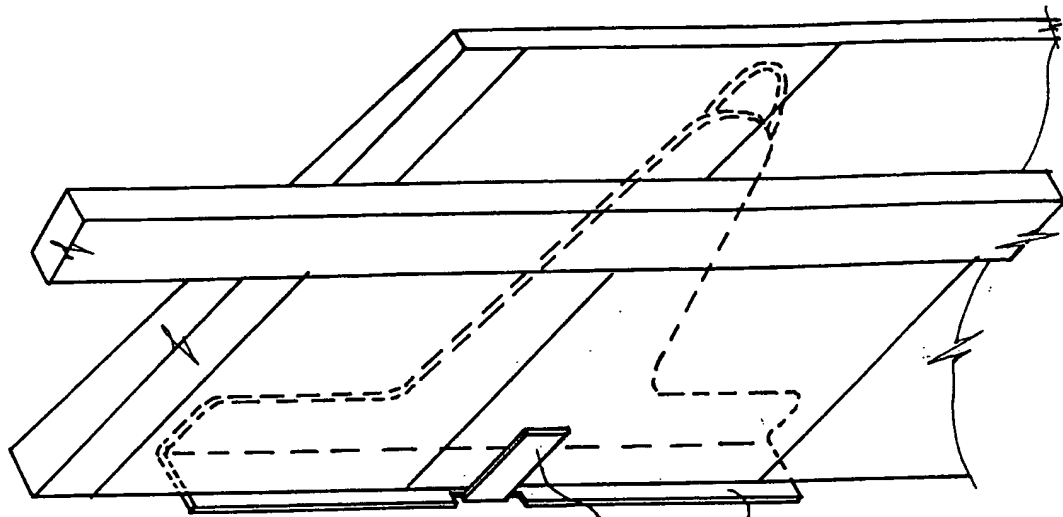


Fig. 7

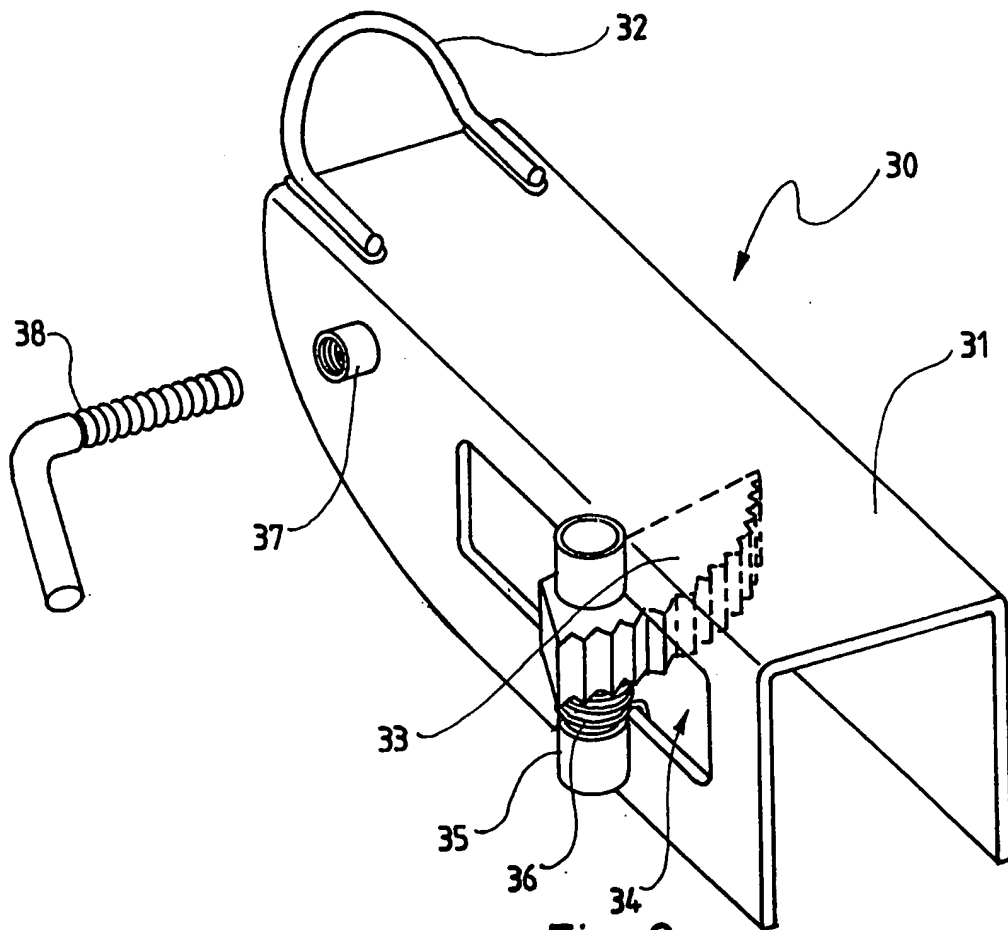


Fig. 8

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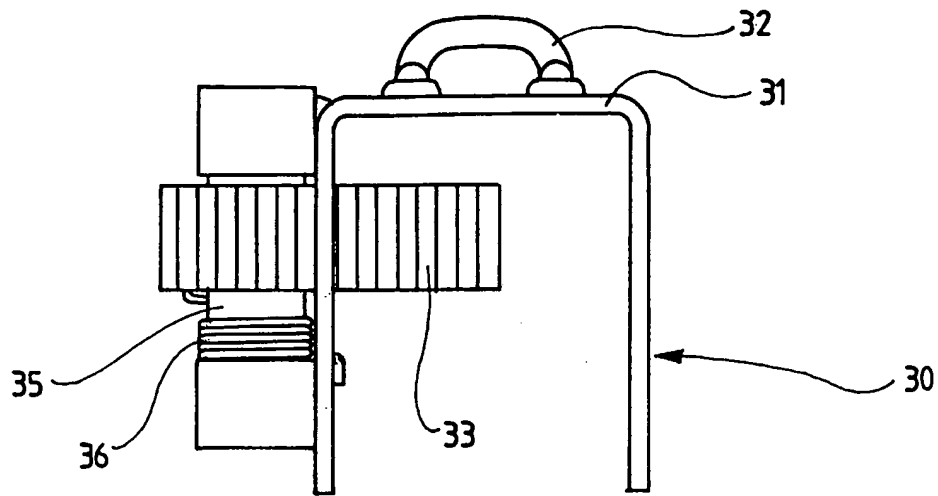


Fig. 9

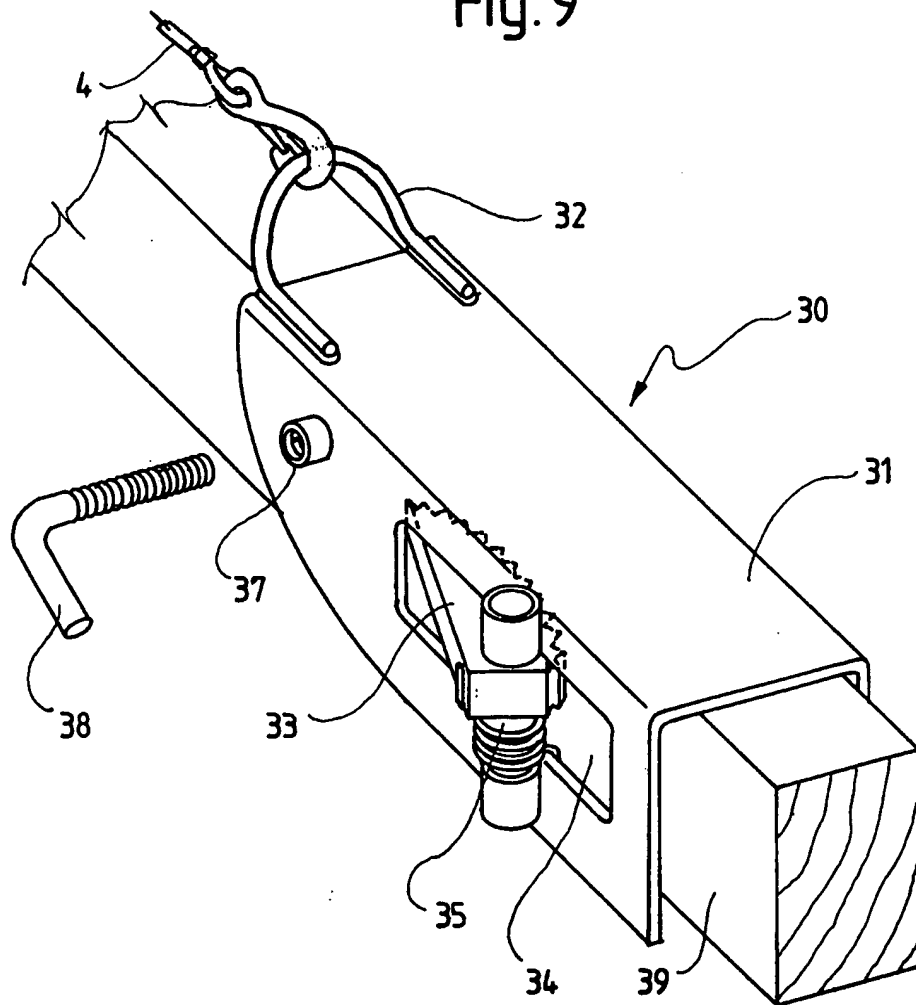


Fig. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 99/00197

A. CLASSIFICATION OF SUBJECT MATTER				
Int Cl ⁶ : E04G 21/32				
According to International Patent Classification (IPC) or to both national classification and IPC				
B. FIELDS SEARCHED				
Minimum documentation searched (classification system followed by classification symbols) IPC: E04G 21/-				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU: IPC as above				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) DERWENT: roof, building, construction, safety, harness, line, frame, beam, roof, rafter etc				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	WO 93/16256 A (BELL) 19 August 1993 Abstract, page 7, figure 1	1,7-9,13-15		
X	WO 94/17261 A (PATERSON & SON) 4 August 1994 Abstract	1,7,9		
X	US 5370202 A (NICHOLS) 6 December 1994 Columns 1-5	1,7,9		
X	GB2251020 A (CRAWFORD) Abstract	1,7,9		
<div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex </div>				
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Date of the actual completion of the international search 9 April 1999		Date of mailing of the international search report 16 APR 1999		
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 99/00197

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2283526 A (PRIME ROOFING LTD) 10 May 1995 Pages 1-3	1,7,9
X	EP 363234 A (PELTIER) 11 April 1990 Abstract, figures	1,7

INTERNATIONAL SEARCH REPORT

International application No.

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Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

- 1 Claims 1-9
Means adapted to be fixed adjacent one edge of the roof.
- 2 Claims 10-12
Hook-like configuration to hook onto bottom edge of roof cladding.
- 3 Claims 13-15
Clamp having a toothed cam member adapted to engage a frame member.
1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

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Box II (continued)

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion, the International Searching Authority has found that there are three inventions:

- 1 Claims 1-9 are directed to a roof safety system having means adapted to be fixed adjacent one edge of the roof. It is considered that the means adapted to be fixed adjacent one edge of the roof comprises a first "special technical feature".
- 2 Claims 10-12 are directed to a roof anchor having a hook-like configuration to hook onto the bottom edge of roof cladding. It is considered that the hook-like configuration to hook onto the bottom edge of roof cladding comprises a second "special technical feature".
- 3 Claims 13-15 are directed to a clamping mechanism having a toothed cam member adapted to engage a frame member. It is considered that the toothed cam member adapted to engage a frame member comprises a third "special technical feature".

Since the abovementioned groups of claims do not share any of the technical features identified, a "technical relationship" between the inventions, as defined in PCT rule 13.2 does not exist. Accordingly, the international application does not relate to one invention or to a single inventive concept.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU 99/00197

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member	
WO	93/16256	AU	36082/93	US	5316102
WO	94/17261	AU	58889/94	EP	681634
US	5370202	US	5248021		
GB	2251020	NONE			
GB	2283526	NONE			
EP	363234	FR	2635980		
END OF ANNEX					